I claim:

1. A method of low-temperature nitridation of a silicon substrate comprising:

placing a silicon wafer in a vacuum chamber on a heated chuck;

maintaining the silicon wafer at a temperature of between about room temperature and 400 °C;

introducing a nitrogen-containing gas into the vacuum chamber;

dissociating the nitrogen-containing gas into nitrogen with a excimer lamp and flowing the nitrogen over the silicon wafer; and

forming an silicon nitride layer on at least a portion of the silicon wafer.

2. The method of claim 1 which further includes maintaining the vacuum chamber at a pressure of between about five mTorr. and 200 mTorr.

3. The method of claim 1 wherein said introducing the nitrogen-containing gas in the vacuum chamber includes providing a gas flow rate of between about two sccm and 50 sccm.

4. The method of claim 1 wherein said maintaining includes maintaining the wafer in the vacuum chamber in contact with nitrogen for between about thirty seconds and three hours.

5. The method of claim 1 which includes forming a silicon nitride layer on a silicon wafer having thickness of between about six Å to 50 Å in a time period of between about thirty seconds to three hours.

6. The method of claim 1 wherein the nitrogen-containing gas is taken from the group of gases consisting of N_2, NH_3, NH_2 and NH, and combinations thereof.

7. The method of claim 1 wherein said forming includes providing a positively charged interface across the nitride layer.

8. The method of claim 1 wherein said placing includes placing a silicon wafer having a layer of silicon oxide on the upper surface thereof in a vacuum chamber.

9. A method of low-temperature nitridation of a silicon substrate comprising:

placing a silicon wafer in a vacuum chamber on a heated chuck;

maintaining the silicon wafer at a temperature of between about room temperature and 400 °C;

introducing a nitrogen-containing gas into the vacuum chamber, wherein the nitrogen-containing gas is taken from the group of gases consisting of N_2, NH_3, NH_2 and NH, and combinations thereof;

dissociating the nitrogen-containing gas into nitrogen with a excimer lamp generating light at a wavelength of about 172 nm and flowing the nitrogen over the silicon wafer; and

forming an silicon nitride layer on at least a portion of the silicon wafer.

10. The method of claim 9 which includes forming a silicon nitride layer on a silicon wafer having thickness of between about six Å to 50 Å in a time period of between about thirty seconds to three hours.

11. The method of claim 9 wherein said maintaining includes maintaining the wafer in the vacuum chamber in contact with nitrogen for between about thirty seconds to three hours.

12. The method of claim 9 which further includes maintaining the vacuum chamber at a pressure of between about five mTorr. and 200 mTorr.

13. The method of claim 9 wherein said introducing the nitrogen-containing gas in the vacuum chamber includes providing a gas flow rate of between about two sccm and 50 sccm.

14. The method of claim 9 wherein said forming includes providing a positively charged interface across the nitride layer.

15. The method of claim 9 wherein said placing includes placing a silicon wafer having a layer of silicon oxide on the upper surface thereof in a vacuum chamber.

16. A method of low-temperature nitridation of a silicon substrate comprising:

placing a silicon wafer in a vacuum chamber on a heated chuck;

maintaining the silicon wafer at a temperature of between about room temperature and 400 °C;

providing a positively charged interface across the nitride layer;

introducing a nitrogen-containing gas into the vacuum chamber;

dissociating the nitrogen-containing gas into nitrogen with a excimer lamp and flowing the nitrogen over the silicon wafer; and

forming an silicon nitride layer on at least a portion of the silicon wafer.

17. The method of claim 16 wherein the nitrogen-containing gas is taken from the group of gases consisting of N_2, NH_3, NH_2 and NH, and combinations thereof.

18. The method of claim 16 which further includes maintaining the vacuum chamber at a pressure of between about five mTorr. and 200 mTorr.

19. The method of claim 16 which includes forming a silicon nitride layer on a silicon wafer having thickness of between about six Å to 50 Å in a time period of between about thirty seconds minute to three hours.

20. The method of claim 16 wherein said maintaining includes maintaining the wafer in the vacuum chamber in contact with nitrogen for between about thirty seconds to three hours.

21. The method of claim 16 wherein said introducing the nitrogen-containing gas in the vacuum chamber includes providing a gas flow rate of between about two sccm and 50 sccm.

22. The method of claim 16 wherein said placing includes placing a silicon wafer having a layer of silicon oxide on the upper surface thereof in a vacuum chamber.